The Material With a Need for Speed

Through licensing from NASA's Langley Research Center, yet another company is enjoying the benefits of NASA's technology transfer program. A Langley-developed material, known as PETI-5, was created for use in the High Speed Research (HSR) program. The technology was licensed to four companies: Culver City Composites, of Culver City, California; Cytec Engineered Materials, of Havre de Grace, Maryland; Fiberite, of Greenville, Texas; and Imitec, of Schenectady, New York. The licensing generated the largest upfront royalty income in NASA's history. Since the original licensing was obtained, Cytec Engineered Materials and Fiberite have merged to form one operation under the name Cytec Fiberite, Inc.

PETI-5 is the commonly used term for phenylethynyl terminated imide oligomers, and the 5 refers to the fifth formulation out of 200 compositions. It is a chemical material that can be used as both a resin and an adhesive. PETI-5 also combines superb mechanical properties and extreme durability with easy processing and environmental stability. For example, the material has temperature capabilities of 350 °F for a lifetime of around 60,000 hours. It is prepared from commercially available materials, making it relatively low cost to manufacture. Curing is done with the application of heat and mild pressure, which results in the formation of a strong, resistant polymer. Due to the nature of this preparation, it is fairly easy to create large and complex parts using PETI-5.

The chemistry behind the creation of PETI-5 involves the preparation of oligomers, or low-molecular-weight imide materials. The oligomers are then capped with phenylethynyl. It is the low molecular weight of the oligomers that allows PETI-5 to be easily processed.

Due to its unique combination of benefits, PETI-5 will be used in the development of the high speed civil transport (HSCT), a concept 300-passenger commercial plane that will travel at a speed of Mach 2.4. Because currently available metals are too heavy and cannot withstand the extreme high temperatures resulting from flying at such high speeds, composite materials made from graphite fibers and PETI-5 are necessary. These materials will withstand the heat, and make the plane strong enough and light enough to be economically viable. Without the characteristics present in PETI-5, it would be impossible to attempt the development of the HSCT.

PETI-5 was the winner of the NASA Commercial Invention of the Year award for 1998. The material received *Research and Development* magazine's R&D 100 award. Cytec Fiberite and Imitec have achieved huge successes with the material in the commercial aerospace industry. And as supersonic civil transports are further investigated by commercial aircraft carriers, the market potential of PETI-5 will continue to expand. Unique opportunities continue to present themselves in the areas of electronic components, jet engines, high performance automotive applications, and beyond. ❖

Cytec Fiberite, Inc., is a global supplier of high-performance composites and adhesives for extreme environments, and offers the PETI-5 material in a wide variety of product forms.